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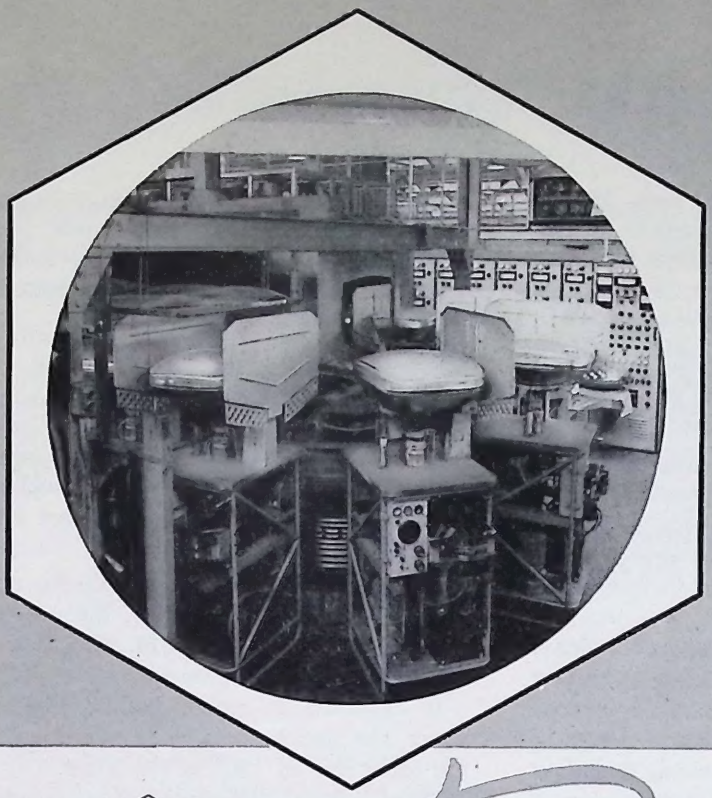
1960
EDITOR: AL JONES



ROGERS Booster

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A MAGAZINE DEVOTED TO THE INTERESTS OF RADIO—TV TECHNICIANS IN CANADA

INDUSTRY NEWS

Radio, T.V. Sales Down from 1959 — Sales of radio and television sets to dealers declined sharply in the first half of 1960. Figures from Electronic Industries Association of Canada show:

Sales of television sets by distributors to dealers of 136,400 in the period, down about 17% from the same 1959 half.

Drop of 12% in radio set sales to 228,846 units.

Running against the main trend, sales of transistorized radios climbed 17% and battery portables were up 15%.

British Television Subject of Enquiry — The future of British television and radio broadcasting will be determined by a new committee of enquiry. A broad range of new services will be discussed, including pay television, closed circuit television, a third channel, and recommendations as to which services should be provided by the tax-supported British Broadcasting Corporation and the commercial Independent Television Authority.

Trans-Canada Telemeter May Franchise Service — Trans-Canada Telemeter Ltd., operator of the pay-television service in Toronto, is considering selling franchises to independent operators. Franchise holders would be given patent rights to equipment and would receive a technical and programme service. In return, the company would take a percentage of gross income.

Multiple Ownership Increase in United States — A Census Bureau survey taken in May found two or more television sets in 11% of the nation's 83 million households, compared with 8% the year before. Only 12% of United States households had no receivers at all compared with 14% in May 1959. The highest proportion, 1.8%, of households with two or more receivers were those containing five persons, presumably reflecting a settlement of family debates over which programme to watch.

"95% To See TV" — CBC President Alphonse Ouimet has predicted that by 1962 close to 95 percent of Canadian homes will be able to receive some Canadian TV service. That is, if the upcoming six licenses for TV stations are approved by the federal Department of Transport and the BBG.

The applications would provide for stations at Cranbrook-Kimberley, B.C.; Coleman, Alta.; The Pas and Flin Flon, Man.; Dryden and Sioux Lookout, Ont.

If approval is received, Mr. Ouimet states, the stations will be in operation in the early part of 1962 at the latest.

He also stated that studies of other areas are being made to provide "a truly national broadcasting service".

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Front Cover

The exhaust ovens — one of the many very critical steps taken to produce Rogers Radiant Screen Picture Tubes. The automatically controlled exhaust ovens, operating above 400° C, force pump the tubes to a very high vacuum removing the last traces of residual gases. Automatic cathode activation ensures stable and adequate emission necessary for long and dependable life.

Back Cover

One of the current Rogers ads showing the new Rogers picture tube carton.

Improvising to Check Hi-Fi Performance

Calibration – With our V.T.V.M. and a 60-cycle source we can quickly calibrate our 'scope. Assuming that the amplifier to be tested has an output inpedance of 16 ohms and we are going to check the frequency response at 1 watt output then, from the table 3, the corresponding voltage is 4 volts.

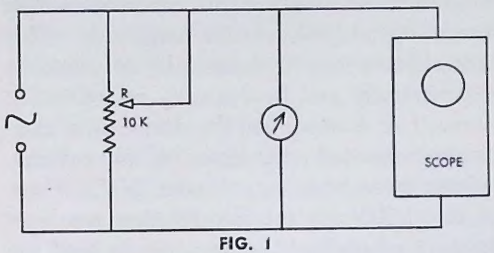


FIG. 1

Now proceed as shown in Figure 1. The 6.3 v supply can be taken from the amplifier itself. Simply adjust R to give a reading on the V.T.V.M. of 4 volts and adjust the 'scope for a suitably sized trace. This is best done by switching off the time base and setting brightness and focus for a well-defined vertical line. Now mark the face of the tube to correspond with the minimum and maximum peaks. Do not touch the vertical controls after this operation. The 'scope is now ready for use as an output meter calibrated for 1 watt across a load of 16 ohms, leaving the V.T.V.M. free for use as required. It follows that the 'scope can be calibrated to indicate any required power output at any given load impedance from the formula

$$W = \frac{E2}{R}$$

The oscilloscope can be further calibrated to indicate a plus or minus db rating. This is done by proceeding as before and then adjusting the input voltage to the 'scope to produce a defection corresponding to plus or minus 1 db of the reference value. Figure 4 gives a table of corresponding db ratios. From this we find that 1 db is a power ratio of 1.25:1. If 1 watt is the reference level then this refers to 4 volts across 16 ohms. Plus 1 db would mean 1.25 watts and from the formula

$$E = W \times R$$

we get a figure of 15 volts approximately. In other words, plus 1 db is an increase of ½ volt and similarly, minus 1 db would be a decrease of ½ volt.

If we now mark the tube at these two new values it can be seen at a glance if the frequency response is within this tolerance. This method of measuring output is perhaps somewhat tedious but it does save the need for a specially designed output meter. However, with initiative and a little practice the results are quite satisfactory.

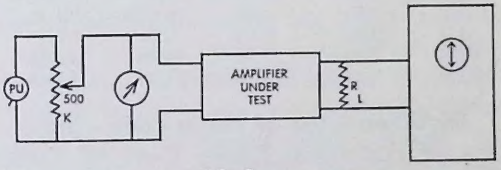


FIG. 2

Audio Generator Not Needed – Having eliminated the output let us see if we can now dispense with the need for an audio generator!

To test any amplifier we need a variable audio frequency and a means of adjusting the input voltage to a constant amplitude at all frequencies. Many record manufacturers now have on the market special test records each having bands of frequencies from approximately 40 to 15,000 cycles in definite steps, each lasting about a minute. Such a record, in conjunction with a high quality pick-up can be a very useful piece of test equipment. If the output from the pick-up is connected to the amplifier as

shown in Figure 2, then by adjusting R at each frequency, we can maintain the required constant voltage. The only limitation to this method is the maximum output voltage available. However, if a high-quality crystal or ceramic cartridge is employed, the output voltage will be sufficient for most tests. It is possible, of course, to increase the voltage range of the "generator" by building a simple voltage amplifier provided the design has wide response and is distortionless. The playing time of each track is adequate to permit setting up and taking of measurements.

The method outlined does not permit any checks for distortion because any distortion present in the input voltage due to either the pick-up or the record itself will be reproduced in the output. It is advisable to check the input waveform with oscilloscope before proceeding too far.

FIG. 3

Power Output	4 ohms	8 ohms	16 ohms	equivalent db. above ref. level of 1mW
100 mW	.63v	.9v	1.27v	20 db
500 mW	1.4v	2.0v	2.8v	27 db
1 W	2.0v	2.8v	4.0v	30 db
2 W	2.8v	4.0v	5.65v	33 db
5 W	4.5v	6.3v	9.0v	37 db
10 W	6.3v	9.0v	12.7v	40 db
20 W	9.0v	12.7v	17.9v	43 db

Distortion — Use of Morse Code — Speaking of distortion, Emory Cook of Cook Laboratories, Inc., introduced some time ago a clever, but novel way to get an aural indication of the presence of high frequency intermodulation distortion in audio equipment. With unique recording technique Mr. Cook developed a record which produces a code sign based on the Morse code letters N and A (Dash-Dot and Dot-Dash respectively).

This method of presenting high-frequency intermodulation signals depends upon having two high-frequency signals simultaneously, related by the rule that the two frequencies when subtracted one from the other shall have a constant difference. Thus, we may take two oscillators, one at 20,000 cps, the other at 19,000 cps, and sweep them down to perhaps 4,000 and 3,000 cps respectively. In so doing we shall cause them to be always 1,000 cps apart. If at some point in their journey from 20 kc to 4 kc there is distortion in the system under test, the quadrature resultant will, of course, contain the difference frequency, 1,000 cps.

Rather then require the user to operate a calibrated piece of equipment to determine the relative magnitude of the 1,000 cycle resultant, it is possible to interrupt periodically one of the "carriers" and to insert in its place a 1,000 cps signal whose amplitude is prearranged to be a certain percentage of the carrier amplitude. This interruption can translate the information conveniently and in a readily recognizable form if it is done in the form of a constantly repeated code letter "A" (dot-dash), whose interstices form code "N's". Thus, if the 1,000 cps intermodulation resultant present when both carriers are on is of the same loudness as the coded 1,000 cps "A", the distortion "N's" and the coded "A's" will complement each other to form a steady tone (with keying clicks).

If the distortion predominates "N's" will stand out. If the distortion is lower than the reference "A", the "A's" will emerge.

FIG. 4

Decibels	Power Ratio
½db	1.12
1db	1.25
2db	1.58
3db	2.00
4db	2.51
5db	3.16
6db	4.00

Cartridges Often Source of Trouble — There are two reasons for putting this signal on a record. First, the coded signal and synchronized sweeps are difficult to arrange, and they require a lot of equipment. The other reason is that a good percentage of troubles are found in the cartridges.

In using the "N-A" test records, perhaps the first thing to do is to listen for coded needle-talk from the cartridge. If one

(Cont'd on Page 6)

Demand Growing for Hi-Fi Service — PART I

With an ever-increasing supply of high quality recordings becoming available, and with FM transmissions gaining more public recognition, coupled with the fact that the radio industry as a whole is putting before the public more and more reproducing equipment under the title of "high fidelity", a new demand is being made on the service industry.

It is the purpose of these articles to clarify the approach to the service of such equipment, and, at the same time, to give some consideration to the functions of specific circuits and their associated components.

High fidelity reproduction is not a product of any one unit, but a result of the whole system. It should be remembered that any system is only as good as its weakest link. Let us consider, therefore, what is required of the "heart" of the system:

The Amplifier — First, to re-create realistic sound quality, the level should be similar to that which would be heard under "live" conditions. Personal preference, however, may dictate a lower level of listening. In any case, this means that the amplifier must be capable of handling peak powers considerably in excess of the average level so as to permit reproduction of peak sounds without overloading and audible distortion. This latter defect, whose existence in High Fidelity amplifiers is intolerable, is due to the presence of frequency components in the output which were not present in the input signal. They consist initially of harmonics of the original frequencies caused by intermodulation between different signal frequencies. In general, the effect of these forms of distortion is to impair the clarity and timbre of the reproduction.

Secondly, the amplifier requires a good transient response. Many sounds in particular those emanating from musical instruments, rise rapidly to a high intensity followed by a relatively long period of decay, for example, the clash of cymbals or the plucking of strings. These sounds are referred to as "transients", whose steeply rising wavefronts can be shown to comprise a very wide range of component frequencies of which some may even be ultrasonic. For faithful reproduction of such transients the system must have a wide frequency response, and, in addition to the foregoing, phase shift must be at a minimum over the complete frequency range, since a variation in the relative phasing of component frequencies of a transient sound results in a change in its aural character.

Now let us consider what is meant by "wide frequency response". It is generally accepted that the human ear is capable of responding to a frequency range of 20 to 15,000 cycles per second. In certain instances, especially among younger people, the upper limit may increase to 20,000 c/s; conversely, with older people the limit may well be below 15,000 c/s. The consideration must be, therefore, not of the individual but of the musical instruments themselves, some of which may extend to around 10Kc/s in the partial tones and considerably higher in their complex forms. In view of this, the amplifier should be capable of handling a range of frequencies at least as wide as those individually audible.

To summarize, the amplifier should fulfill the following specifications:

Frequency range: 20 to 20,000 cycles — 1db.

Total harmonic distortion: Not more than 1%.

Intermodulation distortion: Less than 2% at 40 and 7k cycles r.m.s. sum.

Power output sufficient that overloading does not occur.

Phase shift as small as practicable.

Inaudible hum and noise at normal operating levels.

Good loudspeaker damping factor.

The latter is the ratio of the loudspeaker (s) impedance to the output resistance of the amplifier. The electro-magnetic damping afforded by a low output resistance ensures excellent control of the cone movement over the entire frequency range.

From the point of view of servicing such an amplifier it can be seen that gone forever are the days when a screwdriver or wet finger could be applied to the input grid and a hum or buzz obtained!! High Fidelity service calls for a much more scientific approach. It must be remembered that the Hi-Fi owner is either a connoisseur and critic in the first instance, or else, he rapidly becomes one. He will very quickly detect a falling-off in performance and you will be expected to correct it, although at your first listening nothing may appear to be wrong. Your writer has experienced such complaints many times and the task is not always a simple one. The art of Hi-Fi service is highly specialized and calls for specific test equipment if a good job is to be done. The trouble, of course, may not always lie within the amplifier, but as this is the "heart" of the system, it should be given first consideration.

Tubes will inevitably age, even under correct operating conditions and under incorrect operating conditions this wearing out process can be much accelerated. Since tube performance in high-fidelity amplifiers is a critical element, the tubes must be thoroughly checked, especially in the case of push-pull output stages where dissimilar plate and/or screen currents have drastically adverse effects. Circuit voltages should be measured with care and accuracy and should agree within narrow limits with the manufacturers' specifications. Any wide variation must be viewed with grave suspicion. A word of warning regarding such voltage measurements is felt desirable at this point. Several Hi-Fi amplifiers have somewhat high impedance circuits compared with ordinary radio sound systems and the loading effect of the voltmeter can often produce erroneous results. Luckily, most manufacturers state which type of meter was used to take their original readings and one should be guided accordingly.

So far, the technique applied is quite ordinary practice but it is the necessary basis for further investigation. From hereon the pattern changes. Next week we will cover checking frequency response and "Overall Response".

IMPROVISING TO CHECK HI-FI PERFORMANCE (Cont'd)

hears "N-s" from the cartridge with all the amplifying equipment off, it is hard to escape the conclusion that the cartridge is not tracking. Tracking is a function of the vertical pressure of the stylus on the groove and the motional impedance of the moving armature referred to the tip. For any given high frequency, increased vertical tracking pressure is required to "tack" increasing record volume levels. The higher the level, the higher will be the necessary tracking pressure, until the point comes at which the unit pressures on the vinyl compound are so high in tons per square inch that it gives way to the needle impact. High-frequency intermodulation testing may be used to determine bona fide tracking pressures.

In amplifiers and preamplifiers this testing method readily determines at what operating level overloading of high-frequency signals takes place, and what constitutes a maximum safe setting for treble and volume controls in a home music system. In many cases it will be found that a rather low volume and treble boost setting produces "N's". The effect of having too much gain ahead of the volume control or treble boost circuit will be evident.

By means of volume control adjustments at various points in a system it is possible to determine which unit is offending, and the speaker voice-coil rub can be established by the process of substitution of speakers or by simply removing the high-

(Cont'd on Page 7)

What's New in Tubes?

Products mentioned in the series "What's New in Tubes?" are available through Rogers distributors across Canada. Complete data sheets or further information may be obtained by writing direct to Rogers Electronic Tubes and Components, Technical Information Service, 116 Vanderhoof Avenue, Toronto 17, Ont.

Rogers Frame Grid Pentodes

6EH7	6EJ7
Remote cut off pentode	Sharp cut off pentode
12,500 micromhos	15,000 micromhos

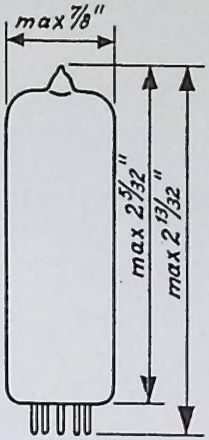
The newest members of the Rogers family of frame grid tubes are these two versatile pentodes, specifically designed for I.F. amplifier use in television receivers. A new high in transconductance is achieved in these two types together with extremely low plate to grid capacity. This makes possible in suitable circuits 2 stage I.F. amplifiers with increased reliability at lower cost or alternatively 3 stage amplifiers with greatly increased performance over those with conventional grid tubes.

An additional bonus contributed by the stronger frame grid is the increased consistency from tube to tube and negligible change in tube characteristics throughout the life of the tube. Television sets equipped with frame grid tubes in the I.F. and R.F. amplifiers will thus continue to give maximum performance long after sets with conventional tubes have deteriorated in performance.

Look for these new frame grid tubes in the new television circuits of today and tomorrow.

$5 Send us your latest original service hint. If previously unpublished and found suitable for publication, you will receive a cheque for $5.00.

TUBE OUTLINE



BOTTOM VIEW OF BASE

1. Cathode
2. Grid No. 1
3. Cathode
4. Heater
5. Heater
6. Internal shield
7. Plate
8. Grid No. 2
9. Grid No. 3

6EH7

Variable-Gain I.F. Amplifier for T.V.

V_f =	6.3 V	I_f =	300 mA
V_a =	190/200 V	I_{g2} =	4.5 mA
V_{g3} =	0 V	S =	12.5 mA/V
V_{g2} =	90V	R_i =	500 k Ω
V_{g1} =	-2 V	G_{g1} =	33 μ ʊ 1)
I_a =	12 mA		

6EJ7

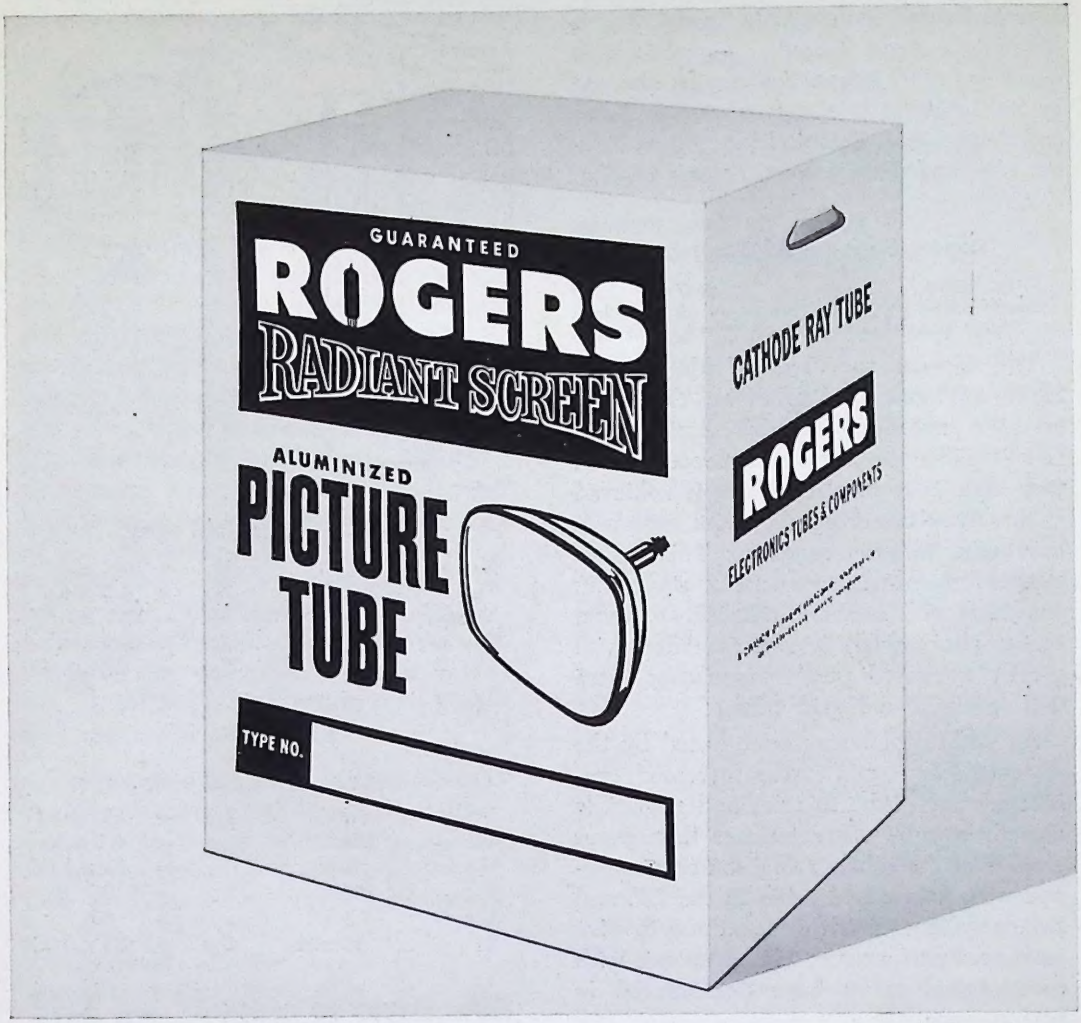
High-Gain I.F. Amplifier for T.V.

V_f =	6.3V	I_f =	300 mA
V_a =	200 V	I_{g2} =	4.1 mA
V_{g3} =	0 V	S =	15 mA/V
V_{g2} =	200 V	R_I =	350 k Ω
V_{g1} =	-2.5 V	μ_{g1g2} =	60
I_a =	10 mA	G_{g1} =	33 μ ʊ 1)

IMPROVISING TO CHECK HI-FI PERFORMANCE (Cont'd)

frequency speaker of a multiple-unit speaker system from the circuit. The telltale 1,000 cps signal will still be audible on the low-frequency speaker if the fault is in the amplifier.

The 2% standard of references set in this record (°) is not to be compared with "2%" as applied to standard intermodulation performance. It is a fairly good standard of performance in the high-frequencies, but not extreme.



The brand **NEW** look in picture tube profits!

Take a good look at this smart new carton from Rogers. Notice the way the design catches your eye, the way it says "quality" for Rogers picture tubes. Check the new hand holds. They've been reinforced to three times the thickness of the carton itself. They won't tear.

The new carton also features a specially designed liner and pad. The advantages? Unusual carton strength plus greater protection against the tube being scratched or chipped. But most important is the tube you'll find inside—a Rogers Radiant Screen Picture Tube. Rogers Radiant Screen Picture Tubes will give your customers the best picture ever for a long, dependable life. It will give you a reputation that will be hard to beat.

ROGERS

electronic tubes & components

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